

Sieck, W. R. (2010). Cultural network analysis: Method and application. In D. Schmorrow & D. Nicholson (Eds.), *Advances in Cross-Cultural Decision Making*, (pp. 260-269). Boca Raton: CRC Press / Taylor & Francis, Ltd.

## CHAPTER 27

# Cultural Network Analysis: Method and Application

*Winston R. Sieck*  
Applied Research Associates  
Fairborn, OH 45324, USA

## ABSTRACT

A method is described for studying in detail the common perspective that members of a culture bring to a situation. The method results in models of the culture that provide a basis for outsiders to begin to frame events from the cultural-insider point of view. The cultural models can then be used to identify priority cultural aspects to emphasize in training, as an aid to anticipating how messages will be interpreted and evaluated by members of the culture, or as a means of diagnosing cultural frictions that impede effective multicultural team functioning. Example applications are presented to illustrate the value of the method.

**Keywords:** Cultural models, cultural epidemiology, decision making, cultural sensemaking training, cross-cultural communications, multicultural collaboration

## INTRODUCTION

The purpose of this chapter is to describe an approach to cultural modeling, cultural network analysis (CNA), and to illustrate some of its applications. Cultural network analysis builds on a foundation of research practices drawn from the fields of cognitive anthropology, cultural and cognitive psychology, and decision analysis. It enhances current cultural research practices by providing a rigorous, systematic method for constructing *cultural models* for groups, organizations, or wider societies. Cultural models derived by CNA are represented graphically as a network of the culturally-shared concepts, causal beliefs, and values that influence key decisions in a particular context (Sieck, Rasmussen, & Smart, 2010). In their most

fully developed form, cultural models also convey detailed quantitative information about the prevalence of their specific components. It is useful to scrutinize the need for cultural modeling techniques in general, prior to describing the method in detail.

### **THE IMPORTANCE OF CULTURAL MODELING**

Considerable effort is being devoted to increase understanding across cultures, and to improve the quality of intercultural interactions. These efforts include: a) the design of training to enable individuals to quickly achieve social competence within a host culture; b) the development of communications strategies for selecting and tuning messages that increase persuasive impact within a cultural group; and c) the design and implementation of systems and processes that enable multicultural teams to leverage the advantages of their diversity to solve challenging problems. One approach for improving performance in intercultural encounters is to capture how culturally-competent individuals think within relevant situations. By studying in detail the common perspective that members of a culture bring to a situation, a model of the culture can be constructed that provides a basis for an outsider to begin to frame events from their point of view. The model can then be used to identify priority cultural aspects to emphasize in training, as an aid to anticipating how messages will be interpreted and evaluated by members of the culture, or as a means of diagnosing cultural frictions that impede effective team functioning.

Why have the social sciences not already provided cultural modeling tools?

Many cultural psychologists have been working under the assumption that a wide variety of cultural phenomena can be understood in terms of a few key dimensions, such as individualism-collectivism (Hofstede, 2001). The cultural dimensions paradigm focused on collecting data on the proposed “essential” dimensions all over the world to describe national differences. As cognitive approaches to culture have been maturing within anthropology and cognitive science, there has been an increased interest in describing and explaining the origins of complex cultural knowledge (Atran, Medin, & Ross, 2005). The promise of these approaches is to enable scientists to examine cultural concepts at a much finer level of granularity that has been achieved in the past. The fine-grained detail permitted removes the speculation required to apply cultural dimensions to particular situations, and allows the cultural perspective on the situation to become obvious. To bring the promise to fruition, a set of techniques is needed to systematically produce cultural models in common formats for ready inspection and objective interpretation. CNA provides a collection of techniques to do exactly this. To understand the CNA method, however, it is necessary to unpack what is meant by culture in the first place.

### **THE NATURE OF CULTURE**

There is a broad, perhaps natural tendency to talk about culture as if it were a concrete, material thing. It is sometimes described as a thing that people belong to, or like a kind of external substance or force that surrounds its members and guides

their behavior. Although it is sometimes difficult to avoid these intuitions, they do not hold up to careful scrutiny. Instead, researchers often informally take nationality as an operational definition of culture. Practically, this allows researchers to study cultural differences by comparing national averages on dimensions. A problem is that numerous studies have consistently found a wide range of variability around the averages. This implies that the nation might provide the wrong level of analysis. The results beg the question - how should we define the boundaries of cultures?

An alternative approach begins by defining culture in terms of the widely shared ideas within a population. Here, “idea” refers generically to concepts, values, beliefs, or other mental representations. To take an example, “cultural” values are simply values that most people within a cultural group agree on as important. Cultural knowledge is knowledge that is shared by most everyone in the population. Taking this conception a step further, it is currently popular within cognitive science to draw on a disease metaphor for understanding cultural ideas, describing the ideas that spread widely through a population and persist for substantial periods of time as especially “contagious” (Sperber, 1996). This suggests that ideas can be studied using some of the same techniques that epidemiologists use to study diseases, and the metaphor is useful in this regard.

## **OVERVIEW OF CULTURAL NETWORK ANALYSIS**

Cultural network analysis is a method for describing ideas that are: a) shared by members of cultural groups, and b) relevant to decisions within a defined situation. CNA discriminates between three kinds of ideas: concepts, values, and beliefs about causal relations. The cultural models resulting from CNA use network diagrams to show how all of the ideas relate to one another. The CNA approach also includes the full set of techniques needed to build cultural model diagrams. This consists of specific methods to: 1) elicit the three kinds of ideas from people in interviews or survey instruments, 2) extract the ideas from interview transcripts or other texts, 3) analyze how common the ideas are between and within cultural groups, 4) align and assemble the common ideas into complete maps. CNA shares many aspects with other approaches to cultural analysis, especially cognitive approaches developed by anthropologists (Garro, 2000). However, it offers some specific aspects as a complete method that distinguishes it from other ways of examining cultures.

### **EMPHASIS ON DECISIONS**

CNA begins by identifying the judgments or decisions of primary interest for study. The decisions chosen arise in specific contexts as defined by critical incidents or scenarios. They are made by members of the cultural group being investigated, typically in a way that is surprising or confusing to members outside the group. Once the key decisions are identified, investigators build models of the cultural ideas that directly influence those decisions. This feature of CNA ensures that the aspects of culture investigated are relevant to practical application, such as training

or communications. Some other approaches begin by considering cultural differences that the researchers hypothesize to be important. Then, studies may be conducted to determine their actual relevance, or products developed based on the assumed relevance. This is a riskier, less efficient process than the CNA approach.

### **EMIC PERSPECTIVE**

CNA aims to directly portray cultural ideas in diagrams just as they are expressed by members of the cultural group. This is sometimes referred to as an “emic” or cultural insider perspective, and is contrasted with “etic” or outsider-scientific explanations of beliefs or behavior. For example, etic approaches involving cultural dimensions tend to rely on the scientists’ theories concerning the implications of some cultural values on other cultural values. The approach generally results in explanations that mix scientific concepts with accounts that come from people within the culture. CNA instead attempts to describe emic cultural ideas using scientific formalisms. With respect to explanation, CNA operates under a broader theory, known as “cultural epidemiology,” that seeks to explain how factors that are external to content knowledge, such as the structural properties of stories or the flow of information in the environment, contribute to the successful maintenance and spread of ideas or models. In the present state of cultural science, a well constructed “emic” cultural model is the most important ingredient for many applications.

### **IDEA NETWORKS**

Cultural ideas are often studied as independent elements, especially in survey questionnaires. For example, researchers might study the extent to which members of different cultures aim to have satisfying relationships with family and friends. Scientists examine correlations between independently measured ideas and interpret the connections between them. CNA takes a different approach. It maps out the cultural ideas in a way that directly shows how they relate to one another from the perspective of members of the cultural group. A key premise of this approach is that cultural knowledge consists of shared networks of ideas. Commonly held causal beliefs provide the connections that bind other ideas together. Although CNA seeks to preserve the content of cultural knowledge as expressed by members of the cultural group, it does represent the idea networks in a common, scientific format. Specifically, CNA employs influence diagrams that have been long used to map out knowledge in decision analysis (Howard, 1989). An example from the domain of romance will help explain how this works. Figure 1 depicts an Arab-American cultural model of romantic relationships. The set of illustrated ideas were extracted from a newspaper article that reported on interviews with Arab-Americans about dating (MacFarquhar, 2006). It is provisional for illustrative purposes.

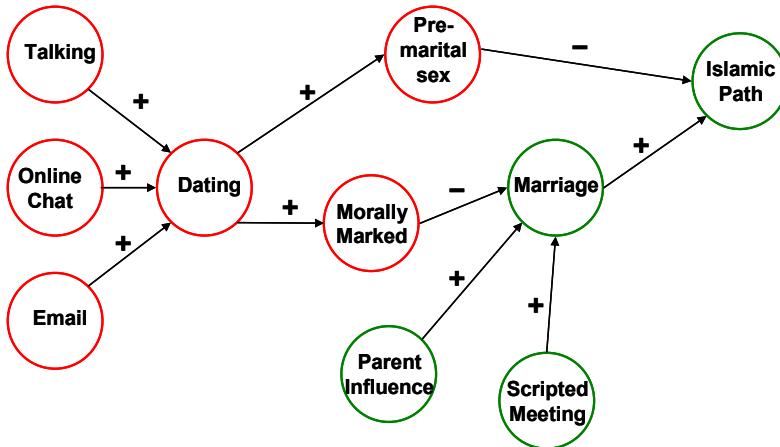


Figure 1. Arab-American cultural model of romantic relationships

Figure 1 depicts a number of ideas using circles, lines, and color. These ideas include simple concepts such as dating and marriage, represented as circles. It also includes causal beliefs, i.e. the antecedents and consequences of romantic activities, such as that dating decreases ones chances of marriage, and of staying on an Islamic path. These are represented as arrows in the figure, with +/- indicating the direction of the causal relation. Finally, desired states or values are portrayed using color. Staying on the Islamic path is a good thing, something one should do. Finding a marital partner is likewise valued. Since dating increases the risk that one will be toppled off of the Islamic path, as well as hampering ones chances of getting married, it should be avoided. Hence, this cultural model is likely to have fairly strong consequences for how members of a cultural group will decide and act.

## PREVALENCE ESTIMATION

When epidemiologists study a disease, they tend to be more specific than just asking whether the disease is widespread or not. They ask “how widespread is that disease?” and then estimate its *prevalence* - the proportion of people who actually have it. Such a step is essential for achieving scientifically rigorous descriptions of the current state of a culture. It is also imperative for understanding changes in prevalence of ideas with any precision. CNA differs from earlier related approaches by taking seriously the need to get to that same level of description with ideas. It asks not just whether the idea is “cultural” (that is, widely shared), but takes the next step to determine precisely how prevalent is the idea in numerical terms.

## **DESCRIPTION OF CNA**

Cultural Network Analysis encompasses both qualitative, exploratory analysis, and quantitative, confirmatory analysis. The specific techniques used to achieve each step in the analysis depend on whether the cultural researcher is employing exploratory CNA or confirmatory CNA.

### **EXPLORATORY CNA**

A primary goal of exploratory CNA is to develop an initial understanding of the concepts and characteristics that are culturally relevant within the domain. In exploratory CNA, concepts, causal beliefs, and values are extracted from interviews and other qualitative sources. Semi-structured interviews employ questions intended to elicit antecedents and consequences of concept states, as in the “explanatory models framework” sometimes used in cognitive anthropology (Garro, 2000). Questioning along these lines draws out a more comprehensive set of ideas than would typically be verbalized in standard think aloud procedures, and places particular emphasis on drawing out perceived causal relations. We have also combined this interview approach with “value focused thinking” from decision analysis to elicit values and objectives directly, along with the causal beliefs that link more fundamental values with the means intended to achieve them (Keeney, 1994). Qualitative analysis and representation at this stage yield insights that can be captured in initial cultural models. Influence diagrams are an important representation format for depicting these models, as described and illustrated above.

### **CONFIRMATORY CNA**

Confirmatory CNA serves to test the structure of previously developed qualitative cultural models, as well as to elaborate the models with quantitative data on the prevalence of ideas in the population(s) of interest. In confirmatory CNA, specially-designed structured questionnaires are used to obtain systematic data that can be subjected to statistical analysis. Most questionnaires treat ideas as independent entities, and so do not provide any means for revealing their interrelated, network form. A few studies have attempted to capture first-order causal beliefs. We have begun developing questionnaires that permit the analysis of longer causal belief chains based on exploratory CNA results. Statistical models are employed in confirmatory CNA to assess the patterns of agreement from the “causal-belief” surveys, and derive statistics describing the distribution of concepts, causal beliefs, and values. Mixture modeling is an approach that permits direct segmentation of cultural groups based on clusters of consensus (Mueller & Veinott, 2008; Sieck & Mueller, 2009). Mixture models have been applied in many scientific fields. In cultural modeling applications, the distinct segments resulting from the analysis represent *cultural groups*, i.e., groups defined by the similarity of their ideas. Finally, influence diagrams of the cultural models are constructed in

confirmatory CNA that illustrate the prevalence of ideas, as well as the qualitative structure elucidated in exploratory CNA.

## APPLICATIONS OF CNA

Cultural network analysis has been used in the development of three kinds of applications so far. It has been used as a method for analyzing cultural knowledge to develop cultural training requirements and content, as a method for designing cross-cultural communications strategies, and as an approach for designing processes and tools that support multicultural collaboration.

### CULTURAL TRAINING

Cultural sensemaking training is an approach for building training that provides learners with cultural knowledge relevant to situations in which they will likely be performing (Sieck, Smith, & Rasmussen, 2008). Cultural sensemaking training compares the cultural models for a specific culture and scenario with novice models of the culture. Learning objectives are derived from an analysis of the gaps and inconsistencies between the cultural model and novice expectations. Training products are then developed on how members of that culture think and decide.

The full CNA process was used to develop several cultural models of Afghan decisions for use in a cultural sensemaking training application. Exploratory CNA was conducted first with Afghan expatriates, using scenario-based interviews to trace the decisions from immediate intentions to fundamental cultural values. The resulting qualitative cultural models were used as a reference to develop a questionnaire for use in confirmatory CNA. To provide a concrete example, we focus on a scenario involving a Mullah who was helping to distribute humanitarian assistance supplies. The Mullah was extremely helpful to the team, yet after finishing with the distribution he kept a truckload of the supplies. The Mullah section of the survey consisted of a series of brief vignettes describing possible intended actions, followed by closed-form questions about the objectives and anticipated consequences of those actions. The sequences ultimately led to seven fundamental values that were derived in the exploratory phase of the study: *status, respect, wealth, power, honor, safety, and family approval*. The CNA survey was translated into Dari and Pashto languages, and administered to 405 participants in Afghanistan through structured face-to-face interviews. The data were analyzed using finite mixture models. For brevity, a fragment of a cultural model is presented for only one of the cultural groups (see Figure 2). As illustrated, participants in this group tended to believe the Mullah would use the supplies in his own household, though reasonable proportions felt he would either sell them, or distribute them among the needy in his village. Interestingly, the majority of possible motivations for Mullah actions link to fundamental values of status and respect. The possibility that the Mullah is simply seeking to increase his wealth appears to constitute a

minority view among Afghans.

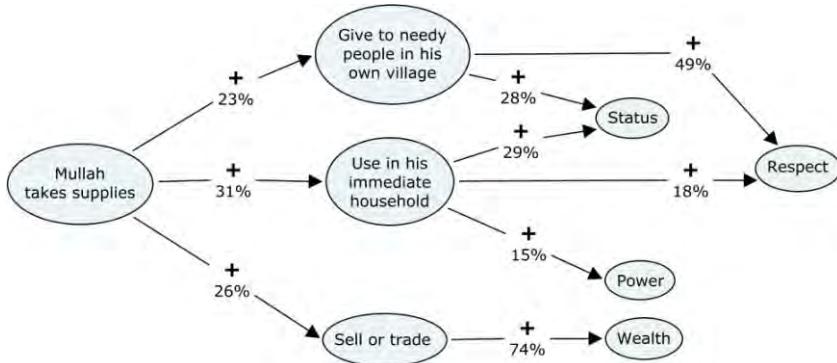


Figure 2. Afghan cultural model of a Mullah's decision making

This and other cultural models were compared with American novice interpretations of the same scenarios to identify training requirements, and ultimately build a set of cultural training materials.

### CROSS-CULTURAL COMMUNICATION

Cultural models can serve as a basis for composing culturally meaningful messages in communications campaigns. This application of CNA was demonstrated in a study about terrorists' operational concepts and perceptions of risk in a nuclear smuggling scenario. Terrorists' ability to plan a viable mission that employs nuclear weapons is determined, in part, by their understanding of the regional actors, systems, and processes that afford desired actions or create risk for the intended operation. This understanding was elicited from experts in terrorist culture and military operations. Initial characterizations of terrorist shared knowledge about the acquisition and transport of nuclear weapons were modeled with influence diagrams, emphasizing concepts and causal beliefs that determine the terrorist groups' perceived risk of failure. For example, a common terrorist belief was that "waterway chokepoints" influence the value of "maneuverability," and decreased maneuverability was believed to increase the chances of being interdicted.

In a cultural models diagram of this kind, each concept and causal belief represents an opportunity to affect perceptions, such as increasing the perceived risk of mission failure. Hence, the diagrams provide a systematic basis for determining the content of communications. Messages are created so as to activate concept nodes, which then propagate across perceived consequences to stimulate other concepts. These effects spread through the idea network, ultimately changing the overall perception of risk shared by the group. With this CNA approach, information efforts focus on transmitting the most relevant information to affect perceptions in a way that makes sense within the cultural group's understanding. Candidate themes were recommended for influencing terrorist planners'

perceptions of the inherent mission risks based on the cultural models. The results demonstrated the potential value of the CNA methodological framework for characterizing, anticipating, and influencing terrorist understanding and perceptions.

Cultural models also highlight the interrelation between causal beliefs and values, and so can identify causal beliefs that influence cultural value change. Consider the cultural model of Arab-American romantic relationships merely as a convenient example. The cultural model might be changed by focusing on the specific causal chain of beliefs that dating will decrease the chances of marriage. That is, changing the causal belief chain so that dating is seen as increasing the chances of marriage can also affect the relevant value (or attitude) towards dating.

## **MULTICULTURAL COLLABORATION**

A cultural models approach to improving multicultural collaboration focuses on the development of hybrid team cultures (Sieck & Mueller, 2009). Hybrid cultures consist of a simplified set of shared assumptions, rules, expectations, and procedures that permit multicultural teams to function effectively. Hybrid cultures develop naturally over time as teams converge on a common process of interacting. However, cultural models can be used to inform the design of tools and processes that speed up the natural process. To take a concrete example, consider American and British expert planners' cultural models of quality plans (Rasmussen, Sieck, & Smart, 2009). These cultural models guide shared expectations about what the collaborative work product should look like in general form. Rasmussen and colleagues found that British planners' ideas included concepts such as "plan complexity" and "flexible execution," as well as shared causal beliefs such as that complex plans decrease the ability to execute flexibly. Finally, the British planners described ideas about desired/undesired states reflecting value. A summary of the resulting British model is that detailed specification of the rationale for actions in a plan will improve the capability of executors to adapt the plan in order to meet changing conditions. The ability to adapt is an important value, so planning team members are expected to focus much of their effort developing those components of the plan.

In contrast, American planners were found to place a premium on synchronization in execution and so focus on developing detailed actions. They expressed frustration with their British counterparts for spending so much time talking about goals at the expense of fleshing out all the relevant details. Understanding cultural frictions like this is useful for suggesting strategies or tools to improve collaboration. Recommendations included cultural model-based division of roles/functions in combined planning teams, and technologies to enhance multinational collaborative planning performance.

## **CONCLUSION**

We all have the ability to think and speculate about the behavior of objects, events, and other people. We do this naturally in a variety of domains. In the social domain,

we are able to make guesses about other people's thoughts and therefore speculate about their intentions and their motives. Human interaction and communication relies heavily on our ability to anticipate each other's intentions and actions, but that ability is heavily dependent on a shared cultural background. In this chapter, a cultural network analysis method was described for explicitly mapping commonly understood decision making within a cultural group. Specifically, a cultural group's shared knowledge within a situation is analyzed and displayed using a network representation of consensus elements. We also illustrated the use of the method for several applications, including improvements to cultural training, cross-cultural communications, and multicultural collaboration. A core assumption of our program is that peoples' intuitive understandings of others' decisions are fundamental to many more complex domains of interest in cultural research and applications. Hence, investigations using cultural network analysis provide a useful starting point for addressing these more complex cultural domains.

## REFERENCES

- Atran, S., Medin, D. L., & Ross, N. O. (2005). The cultural mind: Environmental decision making and cultural modeling within and across populations. *Psychological Review*, 112(4), 744-776.
- Garro, L. C. (2000). Remembering what one knows and the construction of the past: A comparison of cultural consensus theory and cultural schema theory. *Ethos*, 28, 275-319.
- Hofstede, G. (2001) *Culture's consequences* (2 ed.). Sage, Thousand Oaks, CA.
- Howard, R. A. (1989) Knowledge maps. *Management Science*, 35, 903-922.
- Keeney, R. L. (1994). Creativity in decision making with value-focused thinking. *Sloan Management Review*, 35(4), 33-41.
- McFarquhar, N. (2006). It's Muslim boy meets girl, yes, but please don't call it dating. *The New York Times*, Sept. 19.
- Mueller, S. T., & Veinott, E. S. (2008). Cultural mixture modeling: Identifying cultural consensus (and disagreement) using finite mixture modeling. *Proceedings of the Cognitive Science Society*. Washington, DC.
- Rasmussen, L. J., Sieck, W. R., & Smart, P. (2009). What is a good plan? Cultural variations in expert planners' concepts of plan quality. *Journal of Cognitive Engineering & Decision Making*, 3, 228-249.
- Sieck, W. R., & Mueller, S. T. (2009). Cultural variations in collaborative decision making: Driven by beliefs or social norms? In *Proceedings of the International Workshop on Intercultural Collaboration* (pp. 111-118). Palo Alto, CA.
- Sieck, W. R., Rasmussen, L. J., & Smart, P. (2010). Cultural Network Analysis: A Cognitive Approach to Cultural Modeling. In D. Verma (Ed.), *Network Science for Military Coalition Operations: Information Extraction and Interactions* (pp. 237-255). Hershey, PA: IGI Global.
- Sieck, W. R., Smith, J. L., & Rasmussen, L. J. (2008). Expertise in making sense of cultural surprises. *Interservice/Industry Training, Simulation, and Education Conference (IITSEC)*, December 2008, Orlando, FL.
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Malden, MA: Blackwell.